Announcements
Pick up HW1 if you haven’t done so already
Be preparing for the midterm & working on the first part of HW2 that covers phonology
Next class: midterm review - bring questions!!

Understanding How Phonological Development Works

What we have to account for
(1) Developmental changes that occur in speech perception and speech production
(2) How children ultimately achieve the ability to distinguish and produce sound patterns of their language
Behaviorist Theory

Idea: use behaviorist mechanisms of imitation and reinforcement

Implementation: Babies produce the sounds they do because they imitate the sounds they hear and get positive reinforcement for doing so.

Behaviorist Theory

Problem: Ignores maturational constraints. Some sounds are later because they're harder to physically produce (ex: T, Z), not because they aren't reinforced.

Problem: Parents do not selectively reinforce speech sounds - parents delight in all kinds of sounds children make (ex: laughter, burps, raspberries, ...)

Problem: Phonology isn't just about sounds - it's also about developing mental representations of contrastive sounds (phonemes) and the rules for when sounds are combined together. This isn't conscious knowledge, and so it's not able to be reinforced.

Behaviorist Theory

Basic Problem: Not fundamentally wrong, just mistaken. Positive reinforcement and a rich linguistic environment to imitate certainly help phonological acquisition. They're just not exclusively responsible for it.

Rule & Constraint-Based Approaches

Idea: phonology is a system that represents sounds in terms of features and involves rules that operate over these representations to produce speech. Children's job is to learn the rules and relevant features for their language.

Two instantiations of this:
1. learning applicable phonological rules in Universal Grammar
2. learning rankings of rules in Optimality Theory

English ASPIRATE rule: aspirate stop sound (like "t") at beginning of a word if it's not in a consonant cluster; otherwise do not aspirate it

"top" → [tʰʌp]  "stop" → [stɑp]  "trip" → [trɪp]
Rule & Constraint-Based Approaches

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Notice distribution of sounds & posit rule: ASPIRATE
“top” → [tʰap]  “stop” → [stap]  “trip” → [trip]

Biologically-Based Theories

Idea: phonological system is driven by inherent biological constraints (which then interact with the child’s experience with the language).

Instantiation: development of sound is shaped by the development of the child’s motor capacity.

Support 1: Correlation between development and crosslinguistic variation
Sounds appearing early in infants’ vocal productions are most common sounds among the world’s languages (ex: [m]). Sounds appearing late are the rarest (ex: [l]).

Support 2: Correlation between phonological processes employed by children and crosslinguistic variation
Ex: Children often make a word-final consonant voiceless (ex: “bad” → /bæd/, and this is a process some languages use (ex: German)
**Cognitive Problem-Solving Approach**

Idea: burden is on child’s problem-solving abilities (rather than, say, on biological constraints or prior knowledge). Predicts substantial individual differences, correlating with individual problem-solving abilities.

Support? Research on individual differences still inconclusive. However, there does appear to be a common trajectory, despite disparities in individual problem-solving abilities.

**Connectionist Approach**

Idea: rules are just a human’s way of dealing with regularities in the data. What brains actually do is approximate the sound they intend to produce using a neural network (ex: saying /wəbit/ for “rabbit”).

Instantiation: Neural network representation, where sounds (like /k/) are connected to phonological features (like velar, stop, and voiceless).

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**/kæt/**

Connectionist Approach

**/tæt/**

Pronunciation mistake due to incorrect feature association
Connecting the Connectionist Approach to Speech Perception: The Native Language Magnet Theory

Empirical data: infants learn to distinguish native sound contrasts and to ignore non-native sounds contrasts before they begin word-learning (~10-12 months)

Idea: experience hearing sounds of one language alters infant’s perception of distances among sounds, making differences that do not matter perceptually smaller and differences that do matter perceptually larger.

The Native Language Magnet Theory

Infants maintain contrasts being used in their language and lose all the others.

Natural boundaries (acoustically salient)

Patricia Kuhl

“Perceptual Magnet”

Connecting the Connectionist Approach to Speech Perception: The Native Language Magnet Theory

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Language data

Natural differences (acoustically salient)

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Sounds from Language 1

Patricia Kuhl

“Perceptual Magnet”
The Native Language Magnet Theory

Infants maintain contrasts being used in their language and lose all the others.

Boundaries that are maintained to keep these sound clusters distinct

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Sounds from Language 2

“Perceptual Magnet”

Patricia Kuhl

The Native Language Magnet Theory

Infants maintain contrasts being used in their language and lose all the others.

Boundaries that are maintained to keep these sound clusters distinct

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Patricia Kuhl

The Native Language Magnet Theory

Infants maintain contrasts being used in their language and lose all the others.

Cross-linguistic variation in which contrasts are maintained, depending on language input

“Perceptual Magnet”

Patricia Kuhl
The Native Language Magnet Theory

Perceived acoustic distance ≠ Actual acoustic distance

The perceived acoustic distance between these sounds is smaller (because they are within the same category) - even though acoustically they are pretty separated.

Patricia Kuhl

“Perceptual Magnet”

Connecting the Connectionist Approach to the Native Language Magnet Theory

Idea: Exposure to native language data produces dedicated neural networks in the brain for processing native language sounds. If patterns come in that do not match the feature associations in these neural nets (ex: from a foreign language), these patterns are not processed - and so not perceived.

velar  nasal  palatal  fricative  voiced

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Theories of Phonological Development: Recap

Multiple theories proposed to explain empirical data on children’s speech perception and speech production.

Some are not compatible with current data (ex: behaviorist), while most others are able to explain some aspects of the current data, if not all aspects.

Current approaches differ in whether they view development as acquisition of actual rules or instead as acquisition of regularities in the input.

Questions?